1. Department, number, and title of course

Department of Civil Engineering, CENG 5365, Dynamic Transportation Network Modeling

2. Graduate Course

3. Course (catalog) description

Introduction to the optimization and modeling methodologies required for the analysis of dynamic and stochastic transportation networks. Principles of dynamic network equilibrium via simulation and mathematical programming approaches. Topics include time-dependent routing algorithms, analytical-, cell transmission- and simulation-based dynamic traffic assignment, network paradoxes, network reliability, dynamic network design, and some stochastic extensions.

4. Prerequisite(s)

CENG 5363 Transportation Network Analysis and CI.

5. Textbook(s) and/or other required material


6. Course Objectives

- Develop an organized analytical approach to modeling, analyzing, and solving dynamic transportation network problems.
- Formulate mathematical models describing the evolving dynamic network flow conditions of traffic, stochastic conditions that arise, and network design.
- Apply time-dependent optimization techniques specialized for such transportation models.
- Analyze models and solutions to make decisions to improve the performance of the stochastic and dynamic transportation network system.

7. Topics Covered

- Dynamic network representation: network notation, time-expanded networks, properties and characteristics (FIFO, dynamic flows, etc.).
- Time-dependent shortest paths: label correcting algorithms, complexity and properties, stochastic cost extensions.
- Dynamic traffic assignment: early performance function-based formulations, optimality conditions, simulation-based models.
- Cell transmission model for traffic flow: hydrodynamic traffic flow, derivation of cell transmission model, properties and extensions of CTM
- Linear programs for DTA and network design: modeling CTM with inequality constraints, development of DTA objectives, analysis of the dual and proofs of correctness, extensions for network design and uncertainty

8. Class/laboratory schedule, i.e., number of sessions each week and duration of each session

LESSONS: 45 @ 50 min (3.0 Att/wk)  
LABS: None

9. Contribution of course to meeting the professional component

3.0 Credit Hours (ES=2.5, ED=0.5)
This is a graduate level transportation engineering course that focuses on dynamic transportation network analysis including models, solution algorithms, and implementation techniques used in stochastic and dynamic transportation systems. The course incorporates government and industry standard manuals and software for engineering planning and analysis. It provides the principles of dynamic transportation network analysis and modeling techniques needed in transportation industry planning, operations, management, design, and analysis.

10. **Relationship of course to program outcomes**

The course director’s assessment of how this course contributes to the civil engineering program outcomes is listed below. The following scale is used: 1=No Contribution; 2=Small Contribution; 3=Average Contribution; 4=Large Contribution; 5=Very Large Contribution

<table>
<thead>
<tr>
<th>CIVIL ENGINEERING PROGRAM OUTCOMES</th>
<th>Course Director Assessment</th>
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<tbody>
<tr>
<td>Students who qualify for graduation with a civil engineering masters will demonstrate:</td>
<td></td>
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<tr>
<td>Have specialized knowledge in an area of civil engineering beyond that normally expected at the undergraduate level.</td>
<td>5</td>
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<tr>
<td>Are adequately prepared for advanced professional practice.</td>
<td>3</td>
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<tr>
<td>Completing a thesis or design project address a civil engineering problem using sound engineering principles and techniques.</td>
<td>4</td>
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<tr>
<td>Solve an engineering problem of importance to the State, the Nation, or the Global community.</td>
<td>3</td>
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<tr>
<td>Demonstrate the ability for independent life-long learning.</td>
<td>4</td>
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<tr>
<td>Have effective oral, written, and graphical communication skills.</td>
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11. **Person(s) who prepared this description and date of preparation**

Dr. Wei (David) Fan, E.I.T., Assistant Professor, 6 June 2008.